

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

SPECIFICATION

INVENTION:        DISPLAY ARRANGEMENT FOR FADING OPTICAL INFORMATION INTO  
                  AN OBSERVER'S FIELD OF VIEW

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DISPLAY ARRANGEMENT FOR FADING OPTICAL INFORMATION INTO AN  
OBSERVER'S FIELD OF VIEW

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The invention relates to a display arrangement for fading optical information into an observer's field of view.

[0002] A display arrangement of this generic type is disclosed, for example, in U.S. Patent No. 5,348,477, and further technical environment is provided in German Patent Document DE 40 09 947 A1 and German Patent Document DE 196 20 658 A1. U.S. Patent No. 5,348,477, however, relates particularly to the optical construction of the picture transmission device. The manner of fastening and adjusting the display arrangement in front of the eye is not discussed.

[0003] Furthermore, from U.S. Patent Nos. 5,585,871; 5,266,977; and 4,796,987 disclose display arrangements for fading optical information into an observer's field of view, in which glass fiber optical waveguides are provided for picture transmission between a picture source and an eyepiece. Such glass fiber optical waveguides are disadvantageous due to safety considerations, and the risk of breakage.

[0004] It is an object of the invention to provide a flexible display arrangement with simple adjusting possibilities.

[0005] This and other objects and advantages are achieved by the display arrangement for fading optical information into an observer's field of view according to the invention, which has a picture source, a picture transmission device and an eyepiece. This display arrangement can be worn on the head and, for this purpose, preferably has a fastening device which interacts, for example, with a spectacle frame, a head band or a helmet.

[0006] At least a part of the picture transmission device consists of a fiber optics section which comprises a bundle of acrylic optical waveguides that are flexible, and not fragile. This fiber optics section is at least partially surrounded by a material, preferably metal, which is bendable and which remains in the shape assumed as a result of the bending (mechanical memory effect). The sheathing according to the invention is preferably an aluminum tube which is glued together with the fiber optics section.

[0007] This invention provides a simple and cost-effective adjusting device of the eyepiece in front of the eye.

[0008] According to a feature of the invention, an adjusting mechanism is provided between the picture source and the picture transmission device, for securing the picture transmission device in its momentary (axial) position after a torsion movement in the fiber optics section. In this manner, the picture which appears

before the eye by way of the eyepiece, can be rotated by a torsion of the fiber optics section. This permits a simple and optimal alignment of the picture.

[0009] In another advantageous embodiment of the invention, the eyepiece has optical elements and a setting mechanism for setting the optical elements. Here, the optical elements preferably have lenses, the setting mechanism preferably being a rotatable ring for setting the focus. As a result, the clarity of the picture can be adjusted directly at the eyepiece.

[0010] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 is a schematic block diagram of the display arrangement with a possible control device; and

[0012] Figure 2 is a possible embodiment of the display arrangement for a fastening on a motorcycle helmet.

#### DETAILED DESCRIPTION OF THE DRAWINGS

[0013] In Figure 1, a picture source 10 is connected with a picture signal generating unit 11, which is controlled by way of a control unit 13 and is supplied with electric energy by way of a battery 12. The picture source 10 is, for example, a controllable small LCD module, as known from German Patent Document DE 40 09 947 A1. The signals can be transmitted between the picture signal generating unit 11 and the picture source 10 can be transmitted, for example, by radio or via cable.

[0014] The picture source 10 is connected with a cylindrical holding part 7, which together with an adjusting screw 15, forms an adjusting mechanism.

[0015] A rod-shaped lens 8 is connected by way of a glued connection 9 with a fiber optics section 5 in the form of an acrylic optical waveguide. The lens 8, the glued connection 9 and the fiber optics section 5 form a picture transmission device between the picture source 10 and an eyepiece 1. The eyepiece 1 has optical elements in the form of a mirror 2 and a biconvex lens 3. By way of a setting mechanism 4 in the form of a rotatable setting ring, the distance can be changed between the mirror 2 and the lens 3, whereby the focus can be set for reaching the required sharpness.

[0016] The eyepiece 1 is connected with the fiber optics section 5 by way of a flange 17. The fiber optics section 5 is

at least partially surrounded by an aluminum tube, which can be bent to adjust the eyepiece in the desired position in front of the eye 14. For fastening the entire display arrangement, a clamp 16 can be mounted around the aluminum tube 6 (for example, for the fastening on a crash helmet). It is important that, as a result of the flexible fiber optics section 5 in conjunction with the bendable metal sheathing, a very simple adjusting mechanism is achieved.

[0017] As a result of the adjusting mechanism between the picture source 10 and the picture transmission device 8, 9, 5, consisting of the holding part 7 and the adjusting screw 15, the picture transmission device can, after a torsion movement (which is permitted by the flexible fiber optics section 5), be secured in its momentary position. As a result, a rotation of the picture is permitted in the eyepiece 1 without having to change the position of the picture source 10.

[0018] Figure 2 again shows the display arrangement of Figure 1 according to the invention without the picture signal generating unit 11, the control unit 13 and the battery 12. These three components 11, 12 and 13 absent in Figure 2 may be housed at an arbitrary site during a radio remote transmission. The picture source 10 is preferably fastened on the rear of a helmet. The clamp 16 is preferably mounted on the side of a helmet. The eyepiece 1 is set in the direct proximity in front

of the eye 14. The display arrangement can be used, for example, for displaying vehicle data, particularly the speed or the rotational speed or for displaying navigation data.

[0019] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.